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UNITED STATES DEPARTMENT OF AGRICULTURE
Research Program Development and Evaluation Staff
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CURRENT SERIAL RECORDS

REPORT AND RECOMMENDATIONS
of the
GRAIN AND FORAGE CROPS RESEARCH ADVISORY COMMITTEE
Developed at its Meeting
February 28 - March 4, 1966
Manhattan, Kansas

Committee Membership:

Lloyd E. Arnold, Seed Producer and Distributor, Arnold-Thomas Seed Service,
Fresno, California
Dale W. Bohmont, Dean, College of Agriculture and Director, Agricultural
Experiment Station, Reno, Nevada
Richard B. Feitshans, Grass and Forage Producer, Perry, Georgia
J. W. Fielder, Alfalfa Producer and Processor, Dixon, California
John M. Greig, Grain Producer, Estherville, Iowa
K. K. Keneaster, Product Services Director, Uncle Ben's, Inc., Houston,
Texas
Clay W. Kennedy, Grain Producer, Brownville, Nebraska
Dean McNeal, Executive Vice President, The Pillsbury Company, Minneapolis,
Minnesota
A. Lars Nelson, Master, Washington State Grange, Seattle, Washington
B. Regnar Paulsen, Rice Producer, Woodland, California
Paul E. Ramstad, Vice-President, Research and Development, American
Maize-Products Company, Roby, Indiana
Jefferson S. Schlesinger, Laboratory Director, Union Equity Coop Exchange,
Enid, Oklahoma
Dwight S. Tolle, Romeiser Grain Company, Salina, Kansas
Fred J. Watts, Jr., General Manager, Grain Division, Farm Bureau Marketing
Association, North Charleston, South Carolina

Additional copies of this report may be requested from W. C. Dachtler,
Executive Secretary, Grain and Forage Crops Research Advisory Committee,
Research Program Development and Evaluation Staff, U. S. Department of
Agriculture, Washington, D. C., 20250

PREFACE

The annual meeting of the Grain and Forage Crops Research Advisory Committee was held in Manhattan, Kansas, February 28 through March 4, 1966, with twelve of the fourteen members present. The sessions on the first day were open to the public. During this period the following representatives of agricultural and industry organizations presented their views concerning research needs:

Charles W. Pence, Special Assistant to the President, Great Plains Wheat, Inc.

H. C. Schaefer, Director of Research, American Dehydrators Association

Fred H. Mewhinney, Washington Representative, Millers' National Federation

W. C. Theis, representing Grain and Feed Dealers National Association

Part of the first afternoon was spent touring research of the Kansas State University Feed Milling, Flour Milling and Baking Departments and the USDA Hard Winter Wheat Quality Laboratory. On Thursday afternoon, a second tour was made to research facilities of Kansas State University and the USDA including work in agricultural engineering, stored product grain insects, agronomy and dairy.

As a basis for its recommendations and comments, the Committee made a systematic review of the Department's research programs for grain, rice, forage, feed and seed, as summarized in a Progress Report supplied to the Committee in advance of the meeting. The Progress Report material was supplemented by oral reports, visual materials, and discussion by program leaders and research administrators from the following USDA research divisions and agency units: Crops; Entomology; Agricultural Engineering; Nutrition and Consumer Use; Northern, Southern, and Western Utilization; Market Quality; Transportation and Facilities; Marketing Economics; Standards and Research; Economic and Statistical Analysis; and Farmer Cooperative Service.

Dr. S. R. Hoover, Assistant Deputy Administrator, Nutrition Consumer and Industrial Use Research, Agricultural Research Service, acted as Chairman during the meeting. The Executive Secretary was W. C. Dachtler, Head, Research Advisory Committee Secretariat, Research Program Development and Evaluation Staff.

After careful review of the information available, and based upon the current and future need for new knowledge, and the seriousness of problems faced by the industry, the Committee made the comments and recommendations included in this report to the Secretary of Agriculture.

COMMENTS AND RECOMMENDATIONS

GENERAL

Greater Research Effort Necessary in Support of "Food for Freedom"

".... I warn you the time is not far off when all the combined production, on all of the acres, of all the agriculturally productive nations will not meet the food needs of the developing nations -- unless present trends are changed.... I PROPOSE THAT THE UNITED STATES LEAD THE WAR AGAINST HUNGER!"

These were the words of the President of the United States in his "Food for Freedom Message."

If, then, this is our agricultural goal, and most agriculturists agree with this; greater effort in expanded research must accompany this course as a part of the action program. The trend in recent years of budgetary cuts for research must be halted. Those responsible for providing the means of support for agricultural research must recognize the need for expanded research and provide the increments of manpower and tools to accomplish the task ahead.

Importance of Basic Research

It is well that to some degree that we measure the results of research in terms of output and its relation to cost input. This method of planning, programming and budgeting can be a useful tool in deciding where the research dollar is to be effectively spent. However, caution should be exercised in this type of decision making to not lose sight of the irreplaceable values of basic research. This is a most important fact that both Congress and administrative officials must keep in mind.

Providing for Annual Cost Increases in Research Budgets

For several years those concerned with budgeting for research have been confronted with the incremental increase in cost of the tools for research. These cover a wide band of needs such as supplies, machines, facilities, etc. The need to increase funds just to cover this annual increase, which has been reported to be approximately 6% per year, has often been compensated for by cutting into other research needs. This has often eliminated important positions or essential tools vital to the research effort. This Committee strongly urges that again those charged with provision of means recognize this annual need and provide for it without letting it affect other much needed avenues of research.

Economic Farm Units

Knowledgeable individuals in the U.S., both in and out of government, recognize that agricultural units are going to continue to merge, consolidate, and grow toward the larger type farm enterprises. It is time that we give official recognition to this feature of growth. Economic research should recognize this trend and provide a basis on which the administrators and the Congress may take appropriate action.

Improving the Public Image of Agriculture

The Committee again endorses and recommends that continued effort on the part of Department of Agriculture be directed toward improving the public's image of the agricultural industry. More effort on the part of industry is required to interest and recruit young people to enter into this manpower short field. Publicity of the manpower shortage and the attractive openings should be given wider circulation.

Use of P.L. 480 Funds for Research

P.L. 480 funds have been used to advantageous purposes in most instances. Upon termination of this law in the near future, the whole program should be evaluated and extended. The principles of these funds are quite acceptable, but an improved version of the law could facilitate a better use of these counterpart monies in certain areas.

Sources of Protein

In view of expanding world population, the need for high quality proteins will increase. The Committee recommends that research be expanded to establish the quality and availability of proteins in cereals and forage and their conversion into acceptable and usable forms.

Pesticide Tolerances

This Committee endorses the recommendations by the Pesticides Residues Committee of the National Academy of Science, National Research Council on pesticide levels in food and feed products; i.e., "It is illogical to associate a tolerance value with the ability of chemists to detect smaller and smaller amounts. Thus we wish to subscribe to the recommendations of the foregoing Committee as it pertains to future registration based on negligible or permissible residues in place of no residue or zero tolerance." Research should be expanded in the field of natural resistance of plants to harmful insects and diseases because of the ever present hazard of pesticide residues.

Complete Problem Approach

As research problems become more complex, there is a growing need for strengthening the broad interdisciplinary approach to many problems. Wherever possible, the talents of scientists in several disciplines and branches of the USDA and other research groups should be brought together as a complimentary and coordinated team. In this way maximum results in a minimum time may be achieved with the most efficient use of the research dollar.

Balance of Payments

The USDA should direct more of its research effort towards developing a basis for increasing exports of agricultural products which will expedite a more favorable balance of payments and take full advantage of the American agricultural production potential.

Automation of Project Information Retrieval System

The USDA is encouraged to move as rapidly as possible to an automated research project information retrieval system which includes all component organizations involved in agricultural research.

Continued Support and Cooperation with State Research Programs

The proposed reduction of federal assistance and associated earmarking of funds to State experiment station and agricultural extension programs is viewed with alarm by this Committee. It seems particularly inappropriate to consider reducing research and education in agriculture at a time when there is so much concern over feeding all the peoples in the world.

The federal-state programs under the Hatch, Morrill, and Smith Lever funds are and have been referred to as being productive and efficient. This has come about through the fact that they are well organized, staffed, and administered. It has been possible to obtain high caliber staff members because people had trust in the stability of the funds. Drastic cuts in these programs should not even be considered, because experience has proven one cannot build good staff organizations with cuts in budgets or on temporary funds.

With such instability, losses of qualified scientists and research personnel to private industry will increase rapidly. Even though budgets might be restored in the future, research work started and halted does not necessarily resume readily. Only through continued support will it be possible to continue the successful cooperative State-USDA effort.

Maintenance and Promotion of Senior Scientists

The USDA must encourage a strong core of research leadership. To this end the Committee recommends salary adjustment and project support to meet the keen competition for scientific talent.

Controlled Environmental Production of Food and Fiber

In view of the population explosion, the world wide discrepancy between the demand for food and actual production and President Johnson's "Food for Freedom Message" to Congress, in which he asks that we ".... apply all of the resources of technology to increasing food production," the Committee suggests, where it is applicable, that the concept of controlled environmental production of food and fiber be explored.

FARM RESEARCH

Culture, Breeding, Disease, and Varietal Evaluation

The Committee wishes to recognize the efforts of researchers to adjust low-priority programs of work toward the more demanding aspects of crop variety improvement. The basic studies into heterosis, male sterility and physiology are essential in all crops and must be intensified. This can be achieved only

through more adequate fiscal support. The drastic budget reductions proposed in the areas of corn, sorghum and wheat cannot be tolerated, not only from the view of the industry but from the view of the nation's welfare. One need only review the problems of crop disease and management to realize that without the recent developments made in plant improvement, our nation would not be projecting programs to feed the world, it would be concerned about feeding itself.

Special consideration must be given to new demanding areas in grass and forage improvement but not to the exclusion of new demands in the budding field of turf management.

The team approach is becoming more essential in solving the complex interrelated problems in farm research. The Committee is impressed with the breadth and depth of this research area and wishes to draw attention to the previous year's suggestions which have not been completely achieved and reaffirm our support. In addition the Committee believes emphasis should be made in the following areas:

Barley. The discovery of new genetic mechanisms for production of hybrid barley opens an avenue of approach towards hybridization of many economic crops grown in the United States. This presents strong justification for increased support of research pertaining to hybrid barley.

The competition for acreage in regions where malting barley is grown justifies the research needed to develop hybrid barley, and the research is needed to protect the malting quality of the newly developed hybrids.

Corn and Sorghum. We recognize and support the increased emphasis on the study of the corn virus disease complex, but strongly urge no discontinuance of work in the field of natural resistance of plants to harmful insects and diseases of corn and sorghum.

The development of corn types promising increased nutritive value is an area definitely needing further research.

Wheat. The Committee wishes to emphasize continued research on the genetic interaction of resistance to cereal leaf beetle, and the team effort connected with the plant breeding programs now in progress.

The Department should encourage new talent to specialize in studies and research connected with hybrid wheat development. Research for the maintenance of gluten quality in wheats should accompany the development of hybrids. Research should be conducted with regard to the effect of fertilizers on quality and quantity of the gluten of wheat. This should include an investigation of all kinds and combinations of fertilizers.

Oats. Studies should be expanded in the area of research connected with the basic components of oats as they relate to feed and food value. New stiff-strawed oat varieties are needed. In addition research in cereal leaf beetle resistance should be continued.

Oats as a balanced ration as it relates to horse nutrition should be reviewed.

Rice. Research on rice varieties and disease resistance should be continued with special emphasis on blast disease, kernel smut, and resistance to lodging and with recognition of hull color factors as they relate to quality.

In order to prevent confusion at the consumer level the proposal to change the cooking characteristics of short or medium grain to those of long grain rice should be rejected.

Alfalfa. Emphasis should be placed on continued research on biochemical composition, control of alfalfa viruses and the utilization of heterosis. Genetic studies also are needed to achieve higher levels of xanthophyll.

Clovers. Lesser legumes adapted to western range lands are needed.

Forage and Turf. The Committee wishes to reiterate its recommendation for the development of superior drought resistance and salt tolerance. We also urge research for a quick test for forage quality. More knowledge of grass physiology and the establishment and maintenance of turf grasses is needed.

Pasture and Range. The Committee recognizes a need for additional information related to effective range seeding.

Seed Crop Culture. The problems in seed crop culture are essentially the same and we recommend the continuation of research in this area.

Control of Nematodes

Greater emphasis should be given to research on nematodes in an effort to learn more as to the nature of control either through cultural practices or the breeding of resistant varieties. The loss from nematodes of a serious nature is probably limited to only a few crops. However, their occurrence on a large host of crops does make it timely to devote more research effort to possible control since they do attack our grain crops such as corn, wheat, rice, etc., and the legumes and grasses.

Control of Insects

Harmful insects continue to be a serious threat to many of our major crops and do cause substantial annual losses. Thus, it is paramount that continued research be directed toward biological control, insect resistant varieties and a search for predator or parasitic populations. We cannot continue to

chiefly rely upon chemical control of harmful insects due to the ever present threat of pesticide residue. Therefore, the team approach should and must be continued to attain control and/or keep in check a wide host of harmful insects. At the present we wish to call attention to cereal leaf beetle, western corn root worm, alfalfa weevil, rice water weevil, corn borer, Hessian fly, corn ear worm, green bug and numerous insect vectors.

We deplore, as unwise and decidedly short-sighted, the severe proposed reduction in funds to continue the present research program in the field of entomology and plant research to develop resistant varieties to many destructive insects which attack several of our major food and fiber crops.

Control of Weeds

Harmful weeds continue to represent a major loss to crop production in American agriculture on our rangelands, grain crops, pasture, hay, forage and seed crops. Increased research should be directed towards a study of the life history of weeds in an effort to search out the most vulnerable point in their life cycles for control either by cultural practices or by biological or chemical means. Also, we urge continued research on herbicide translocation in plants and carry-over residues in soils which may be injurious to succeeding crops. Weeds which continue to be of paramount importance are: (1) Johnson grass, (2) dodder in legume crops, (3) annual grasses in corn, rice, sorghum and pastures, and (4) deep seeded broad-leaf annuals and perennials.

Also of significant importance is research in connection with the control of brush and weeds on range land. Range land represents one of our great natural resources once it is reclaimed from brush and productive cover is established. It furnishes pasture and grazing areas for livestock and wild game. In order to accomplish the desired goals in this endeavor it will require the team research approach.

Agricultural Engineering

Greater emphasis should be given to agricultural research by application of the "Systems Approach." By this means more efficient handling procedures will evolve in the production processes from planting through ultimate utilization of the product. One example is the mechanization of harvesting, processing, storage and related utilization by livestock of forage.

Within the scope of the "Systems Approach" research should be alert to the danger of product injury which may occur in handling procedures that would allow the invasion of mycotoxins, insect infestation, loss of seed viability or other adverse effects on utilization of the product.

Research should be further implemented as it pertains to the use of electrical, radiological, and sonic means of attracting and/or destroying harmful insects.

NUTRITION, CONSUMER, AND INDUSTRIAL RESEARCH

Human Nutrition

The Committee is pleased by the progress and planning in: (1) studying the metabolic differences between various carbohydrates in the diet, (2) investigating the capabilities of cereal proteins in human nutrition, and (3) better defining the nutrient composition of cereal foods. The potential long-range benefits of research in these areas warrants continuing to give priority to such work with an expansion of effort. Findings are needed to assure the best possible diet for the American consumer as adjustments dictated by an expanding population are made.

The 1965 Food Consumption Survey may be expected, when reported, to provide information useful to those engaged in nutrition education, food processing, and agricultural activities. Because such surveys, which have been conducted every 10 years, are the most reliable indicator of changing food habits and because the rate at which these changes occur may be accelerating, consideration should be given to the desirability of shortening the interval between surveys.

Industrial Uses for Cereals and Forages

A vigorous program directed toward opening new avenues for the industrial utilization of cereal products serves the interests of farmers, industry, and consumers. The Committee commends the Department for planning expansion of its facilities for doing such work. It is pleased to note that those responsible for directing these activities are alert to their responsibilities for periodic review and evaluation of each project.

In an age of unparalleled technological progress it is important to direct utilization research toward fields which offer sizable potential markets. The paper industry offers such a market. But, by no means should efforts be restricted to this single industry.

The Committee recognizes the nearly unlimited potential for development of products by microbiological and enzymatic means and encourages expansion of efforts in this direction.

Chemical and physical data on cereal grains and their products are basic to , developing their industrial uses. The Committee urges greater effort directed to collection and dissemination of such data.

Present investigations are leading to high value protein, rich fractions and low cost fiber fractions of alfalfa. Industrial uses of this fiber fraction should be explored.

Food Uses for Cereals and Forages

Utilization research on wheat and rice has developed a number of new food products. These activities should be continued and expanded in order to develop the greatest possible world-wide acceptance of American cereal products.

Palatability is basic to consumer acceptance of any food. Improving and maintaining flavor in bread is essential if this basic food is to provide its nutritionally proper share of the diet. Recent discoveries should be exploited through expanded research efforts.

Emphasis should be placed on basic studies of the chemical composition, physical, biochemical and nutritional properties and structure of cereal grains including rice and their commercial fractions. Cooperation between the Utilization Research Laboratories and breeders to secure the same subsamples of pure varieties with known history is desirable so that correlation of the findings can be made more easily. Wherever work on certain aspects of composition of other cereal grains is undertaken, it would be desirable to concurrently carry along parallel work on two or three of the important varieties of rice. In this way less preparatory effort would be required than if the studies were done at different times. The completion and publication of the literature compilation on known facts about the chemical composition of rice is overdue and should be expedited.

Developmental research is recommended on new rice products such as high protein rice beverages, high protein rice noodles, animal or fish protein, fortified rice, etc. for use in the developing countries.

The following proposals for expanded research on rice are recommended:

(1) improved milling of rice to minimize breakage; (2) basic and applied research on flavor and aroma of rice; (3) parboiling of freshly harvested rice; and (4) the purported improved flavor quick cooking rice process only to the point of patent application and issue.

With world population growing more rapidly than agricultural production, the need for changing patterns of food consumption is apparent. It may be desirable to begin soon to plan toward developing palatable, nutritious foods for direct human consumption from crops heretofore utilized chiefly as live-stock feeds. In this connection further studies on composition and properties of the feed grains should be directed toward processing and use in foods.

Investigations should be undertaken to develop and evaluate food uses of leaf products from forages. Alfalfa is one of the highest producers of protein per acre among the major crops. Recent developed dry separation processes of alfalfa have produced as high as 30% protein products which indicate the feasibility of fiber elimination. In this connection, further studies should be undertaken to improve palatability, and the biological availability of its constituents.

Feed Uses of Cereals and Forages

As we become more knowledgeable of the constituent levels of forages and feed grains, it becomes important that studies be expanded on the biological availability of these nutrients for various classes of livestock and poultry. In mill feeds biological availability studies should be expanded to include other nutrients and materials, particularly the materials derivable from wheat and wheat mill feeds. Also, work should be initiated on simple, low-cost

methods to increase the energy availability of wheat feed materials for poultry and mono-gastric animals.

The Committee commends the work accomplished on the pigmentation factors of alfalfa and particularly the development of a new chemical assay method. This work should be expanded to other forages and grasses. Work should be continued on the xanthophyll complex and expanded on the unidentified growth reproductive and health factors. Also, work should be expanded on methods of dealing with the low digestibility of the fiber fractions of forages and grains.

Now that dry separation methods for forages are being perfected, which produce a product of low fiber content, investigations should be initiated to further reduce fiber. This might be accomplished through wet process separation.

Utilization studies of wheat products for food and feed should include methods of upgrading wheat mill products. Methods to segregate and standardize high-protein low-fiber fractions for poultry and swine, and low-protein high carbohydrate fractions for ruminants need to be developed.

With the increasing population of horses in the U.S., various grades and fractions of alfalfa and other forages should be evaluated for optimum incorporation into horse rations. There also should be developments of a forage program for dairy cattle and beef finishing feed lots. The investigation facilities at Clay Center, Nebraska are being developed as a livestock research center; and consideration is being given to incorporating into it a center for forage crops research. The Committee endorses this proposal and points up the logic of establishing a forage crop research center in conjunction with and in cooperation with livestock research to complement work at existing centers. Here the forage crops, i.e., corn, sorghum, grasses, and legumes, could be investigated from conception to consumption, through all stages of breeding, growing, feeding and utilization.

MARKETING AND ECONOMIC RESEARCH

The Committee is glad to note that funds for marketing and economic research have not been curtailed and that plans are being developed to build the USDA Grain Marketing Facility at Kansas State University, Manhattan, Kansas. This is a logical location for the facility in close proximity to the already world famous milling, baking and feed laboratories. Funds for this research should not be curtailed as research is the life blood of progress.

This Committee has been much impressed with the research conducted during the past year in all fields that have to do with grain and forages. There was no marketing and economic research described at this meeting that did not appear to be soundly based. The following recommendations are suggestions for emphasis or de-emphasis.

Measurement and Maintenance of Market Quality

Work on improved sampling devices should be continued. The use of large hopper cars, increased demurrage rates, new rail regulations and faster

movement from farm to market can only be of benefit if the inherent risks of poor samples are eliminated or minimized.

Current and accurate information is needed in regard to the grades and condition of exported grains and forages upon arrival at destination in foreign ports.

Research should continue on the chemical, physiological and biochemical changes that occur in stored cereals. This research should aid in determining the reasons for some seeds retaining their viability and vigor better than others. It may point out reasons for changes in milling quality of stored wheat and the drop in the sedimentation values immediately after harvest.

Research on the problem of mycotoxins in cereals and forages should be pursued vigorously. This is particularly applicable in areas where field shelling of corn will force large quantities of high moisture corn into storage.

Rapid and reliable tests should be devised which will indicate the actual baking value of wheat.

Research also is needed on methods to properly evaluate and describe the quality factors of forages to facilitate trading in these commodities.

There is still need for research that will effectively control insects in farm storage. The use of phosphine should be thoroughly investigated.

In commercial storage it is desirable that studies continue with regard to controlled atmospheres. The use of carbon dioxide for the reduction of the amount of fumigants necessary to achieve a kill should be studied. Studies with regard to the control of insects by the use of diatomaceous earth, malathion dusts, radio frequency, irradiation and ultra sound should continue.

The use of DDVP and malathion mixtures (and other products) as a means of controlling insects that might infest cereals while being transported needs investigation.

We recommend that research be conducted in cooperation with the Food and Drug Administration in order to determine tolerances for all chemicals used in the maintenance of quality of cereals, feed grains, forages and their products. We urge the avoidance of zero tolerances where possible. Quick and accurate methods for the detection of residues should be developed.

The seriousness of the possibility of the re-entry to the United States of the Khapra beetle justifies further study of this insect with P.L. 480 funds. It is suggested that similar studies be extended to the Senn bug.

Marketing Facilities, Equipment and Methods

It is recommended that the study of aeration of large flat storage be de-emphasized and that the study of aeration of upright storage be continued.

Studies should continue to determine the most satisfactory methods of drying cereals with special emphasis on corn because of the mycotoxin problem.

Vacuum drying should be considered.

Studies should be made of the use of artificial refrigeration in the storage of damp grain.

Studies to determine where mechanical damage to kernels occur and, as to how this damage can be controlled should continue to be pursued.

Cooperative Marketing

The present program of research appears to the Committee to satisfactorily cover the problems of cooperatives. The benefits of milling and banking laboratories at cooperative terminal locations should be studied.

Economics of Marketing

It is recommended that a study be made with regard to actual costs of transportation of wheat compared to flour to assist in correcting the current imbalance of rates.

More research needs to be done on the adequacy of existing grain facilities to adapt to new transportation equipment such as rail hopper cars, motor trucks and barges as well as the adequacy of the transportation equipment itself.

Impact of multiple-car billing and train-load billing upon the small elevator operators and farmer producers should be studied.

Research should continue for the exploration of the possibility of more economical use of mill feeds as human foods in both domestic and foreign markets. As the pressure of population on food supplies grows, this research will become of greater importance.

Shrinkage has been observed to be greater in some forms of transportation of cereals than in others. The causes need to be investigated.

It is recommended that the market potential for industrial utilization of grains and forages and their by-products be studied to determine the economic feasibility for these products in competition with other materials in the production of paper, fabrics, wall-board, etc.

The fact that a large portion of the world is deficient in protein foods justifies research to determine the greatest possible potential for the use of alfalfa and soybeans in human nutrition.

It is increasingly evident that the United States is going to assume a greater responsibility for feeding the world's hungry people. It is also evident that where the need is the greatest, the dollars are the scarcest. Research should stay ahead of this pressing need for food by determining the peoples' needs and wants for sustenance. In cases of concessional sales the research should give direction to the United States crop that will

adequately fill the need and at the same time constitute the least drain on our domestic resources. In those countries where trade is possible, or payment can be made, every effort should be made to determine what products, and which methods of processing offer the greatest possibilities for market development.

Economic research should be conducted with regard to all aspects of international trade in grain and forage products. The disadvantages of the United States firms in trading with, or in competition to, foreign governments or trading combines should be studied. The Canadian government and the Common Market are examples.

Statistical Data

We recommend continuing efforts to increase the accuracy and the reliability of statistical data in regard to crop production and inventory stock estimates. In view of the present world uncertainties and the acceptance by the United States of the responsibility of feeding a large share of the world's population, studies should be carried out to determine what should constitute an adequate reserve stock of wheat and feed grains in the United States.

